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Monte Carlo simulation of spin-polarized transport

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Abstract

Monte Carlo simulations are performed to study the in-plane transport of spin-polarized electrons in III-V semiconductor quantum wells. The density matrix description of the spin polarization is incorporated in the simulation algorithm. The spin-orbit interaction terms generate coherent evolution of the electron spin polarization and also cause dephasing. The spatial motion of the electrons is treated semiclassically. Three different scattering mechanisms - optical phonons, acoustic phonons and ionized impurities - are considered. The electric field is calculated self-consistently from the charge distribution. The Monte Carlo scheme is described, and simulation results are reported for temperatures in the range 77-300 K. © Springer-Verlag Berlin Heidelberg 2003.